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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/500,455	02/09/2000	Akihiro Katayama	2355.00114	2639

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EXAMINER	
YANG, RYAN R	
ART UNIT	PAPER NUMBER
2672	8

DATE MAILED: 05/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/500,455	KATAYAMA, AKIHIRO	
	Examiner	Art Unit	
	Ryan R Yang	2672	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 February 2004* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,4,10 and 31-39* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *33 and 38* is/are allowed.

6)☒ Claim(s) *1,3,4,10,31,32 and 35-37* is/are rejected.

7)☒ Claim(s) *34,39* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 February 0200* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

1. This action is responsive to communications: Amendment, filed on 2/23/2004. This action is final.

2. Claims 1, 3-4, 10, 31-39 are pending in this application. Claims 1, 10, 31, 33 and 38 are independent claims. In the Amendment, filed on 2/23/2004, claims 1, 10, 31, 33 and 38 were amended.

This application claims foreign priority dated 3/26/1999.

3. The present title of the invention is "Image processing method and apparatus, and storage medium" as filed originally.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1, 3-4, 10, 31-32 and 35-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al. (5,613,048) in view of admitted prior art and Hrytzak et al. (5,327,257).

6. As per claim 1, Chen et al., hereinafter Chen, an image processing apparatus for generating an image of a virtual space according to a user's operating using ray space data comprising:

a recording unit adapted to record the ray space data ("selected views of a scene, from different viewpoints, are recorded", column 3, line 53-54);

an inputting unit adapted to input a user's operation of movement in the virtual space (Figure 2 18 movement control; "The movement of the virtual camera, to present different views of the scene, is controlled by the viewer through a suitable input device 18", column 3, line 40-42);

a setting unit adapted to set a sampling rate for the ray space data read out from said recording unit according to the user's operation, the sampling rate indicating a distance between pixels to be sampled ("interpolation is carried out through image morphing. Generally speaking, image morphing is a simultaneous interpolation of shape and texture. The morphing technique involves two basic steps. In the first step, a correspondence is established between two images ... Typically, the correspondence is established by a human operator ... An algorithm is then employed to determine the correspondence, or mapping, of the remaining points of the images", column 4, line 1-14, "The sampling rate is determined by the largest offset vector from the morph map", column 8, line 26-28, since the morph map is established by a human operator, the sampling rate is indirectly set by a human operator, and "a foreground object in a scene should be sampled at a high rate, while a stationary wall in the background needs only a few samples", column 8, line 35-37, this indicates the sampling rate is a function of distance between pixels to be sampled);

a reconstructed unit adapted to read out ray space data from said recording unit according to the sampling rate set by said setting unit, and to reconstruct an image of the virtual space, the read out ray space data being arranged on a line in the ray space, and being on the line at an interval in accordance with the sampling rate ("Once each of

these views has been stored, the image from any viewpoint between any two of the recorded locations can be obtained by interpolation of two adjacent stored images", column 3, line 60-64; "In the example of Fig. 1, the movement of the virtual camera is one-dimensional", column 7, line 29-30; one-dimension inherently means a line; since the data is stored in accordance with a sampling rate, it is inherent that the read-out data is related to the sampling rate).

Chen discloses an apparatus of generating an image of a virtual space. It is noted that Chen does not explicitly disclose using ray space theory represent an image, however, this is known in the admitted prior art. In the admitted prior art, applicant disclosed a ray space theory has been used to describe a virtual space (page 1, line 19-20).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of admitted prior art into the invention in order to properly describe an image with a moving view point.

It is further noted that Chen and the admitted prior art do not explicitly disclose an interpolation unit adapted to interpolated pixels of the image reconstructed by said reconstructing unit until the size of the image becomes a predetermined size, however, this is known in the art as taught by Hrytzak et al., hereinafter Hrytzak. Hrytzak discloses a method of interpolating a digital image in which "the method can be repeated by moving to the next local position in the input image and so on until the entire image has been interpolated, i.e. until a complete output image of the required size is produced", column 2, line 7-11.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Hrytzak into Chen and admitted prior art because Chen and admitted prior disclose an apparatus of generating an image of a virtual space using ray space theory and Hrytzak discloses the generated image can be interpolated into a desired size in order to maximized the view of the interpolated image.

7. As per claim 3, Chen, admitted prior art and Hrytzak demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Chen further discloses the setting unit determines the sampling rate on the basis of the moving speed in a virtual space designated by the user ("The movement of the virtual camera, to present different views of the scene, is controlled by the viewer through a suitable input device 18", column 3, line 40-42, since the morphing, thus the sampling rate, is determined by the correspondence between two images and correspondence depends on the moving speed of the camera).

8. As per claim 4, Chen, admitted prior art and Hrytzak demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Chen further discloses the setting unit determines the sampling rate on the basis of the manipulation speed of an object in a virtual space designated by the user ("The movement of the virtual camera, to present different views of the scene, is controlled by the viewer through a suitable input device 18, column 3, line 40-42, since the morphing, thus the sampling rate, is determined by the correspondence between two images and the correspondence depends on the moving speed of the camera).

9. As per claim 10, Chen discloses an image processing method for reconstructing an image of a virtual space according to a user's operating using ray space data comprising:

an inputting step of inputting a user's operation of movement in the virtual space (Figure 2 18 movement control; "The movement of the virtual camera, to present different views of the scene, is controlled by the viewer through a suitable input device 18", column 3, line 40-42);

a setting step of setting a sampling rate for the ray space data read out from said recording means according to the user's operation, the sampling rate indicating a distance between pixels to be sample ("interpolation is carried out through image morphing. Generally speaking, image morphing is a simultaneous interpolation of shape and texture. The morphing technique involves two basic steps. In the first step, a correspondence is established between two images ... Typically, the correspondence is established by a human operator ... An algorithm is then employed to determine the correspondence, or mapping, of the remaining points of the images", column 4, line 1-14, "The sampling rate is determined by the largest offset vector from the morph map", column 8, line 26-28, since the morph map is established by a human operator, the sampling rate is indirectly set by a human operator, and "a foreground object in a scene should be sampled at a high rate, while a stationary wall in the background needs only a few samples", column 8, line 35-37, this indicate the sampling rate is a function of distance between pixels to be sampled);

a reconstruction step of reading out ray space data from the recording means in accordance with the sampling rate set in said setting step, and reconstructing an image of the virtual space, the read out ray space being arranged on a line in the ray space, and being on the line at an interval in accordance with the sampling rate ("Once each of these views has been stored, the image from any viewpoint between any two of the recorded locations can be obtained by interpolation of two adjacent stored images", column 3, line 60-64; "In the example of Fig. 1, the movement of the virtual camera is one-dimensional", column 7, line 29-30; one-dimension inherently means a line; since the data is stored in accordance with a sampling rate, it is inherent that the read-out data is related to the sampling rate).

Chen discloses a method of generating an image of a virtual space. It is noted that Chen does not explicitly disclose using ray space theory represent an image, however, this is known in the admitted prior art. In the admitted prior art, applicant disclosed a ray space theory has been used to describe a virtual space (page 1, line 19-20).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of admitted prior art into the invention in order to properly describe an image with a moving view point.

It is further noted that Chen and the admitted prior art do not explicitly disclose an interpolation step of interpolating pixels of the image reconstructed by said reconstructing unit until the size of the image becomes a predetermined size, however, this is known in the art as taught by Hrytzak et al., hereinafter Hrytzak. Hrytzak

discloses a method of interpolating a digital image in which "the method can be repeated by moving to the next local position in the input image and so on until the entire image has been interpolated, i.e. until a complete output image of the required size is produced", column 2, line 7-11.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Hrytzak into Chen and admitted prior art because Chen and admitted prior disclose a method of generating an image of a virtual space using ray space theory and Hrytzak discloses the generated image can be interpolated into a desired size in order to maximized the view of the interpolated image.

10. As per claim 31, Chen discloses a computer-readable storage medium for storing a program which makes a computer function as an image processing apparatus for generating an image virtual space according to a user's operating using ray space data recorded in a memory, the program comprising:

an inputting step of inputting a use's operation of movement in the virtual space (Figure 2 18 movement control; "The movement of the virtual camera, to present different views of the scene, is controlled by the viewer through a suitable input device 18", column 3, line 40-42);

a setting step of setting a sampling rate for ray space data read out from said recording means according to the user's operation, the sampling rate indicating a distance between pixels to be sample ("interpolation is carried out through image morphing. Generally speaking, image morphing is a simultaneous interpolation of shape and texture. The morphing technique involves two basic steps. In the first step, a

correspondence is established between two images ... Typically, the correspondence is established by a human operator ... An algorithm is then employed to determine the correspondence, or mapping, of the remaining points of the images", column 4, line 1-14, "The sampling rate is determined by the largest offset vector from the morph map", column 8, line 26-28, since the morph map is established by a human operator, the sampling rate is indirectly set by a human operator, and "a foreground object in a scene should be sampled at a high rate, while a stationary wall in the background needs only a few samples", column 8, line 35-37, this indicate the sampling rate is a function of distance between pixels to be sampled);

a reconstruction step of reading out ray space data from the memory according to the sampling rate set in said setting step, and reconstructing an image of the virtual space, the read out ray space data being arranged on a line in he ray space, and being on the line at an interval in accordance with the sampling rate ("Once each of these views has been stored, the image from any viewpoint between any two of the recorded locations can be obtained by interpolation of two adjacent stored images", column 3, line 60-64; "In the example of Fig. 1, the movement of the virtual camera is one-dimensional", column 7, line 29-30; one-dimension inherently means a line; since the data is stored in accordance with a sampling rate, it is inherent that the read-out data is related to the sampling rate).

Chen discloses a method of generating an image of a virtual space. It is noted that Chen does not explicitly disclose using ray space theory represent an image, however, this is known in the admitted prior art. In the admitted prior art, applicant

disclosed a ray space theory has been used to describe a virtual space (page 1, line 19-20).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of admitted prior art into the invention in order to properly describe an image with a moving view point.

It is further noted that Chen and the admitted prior art do not explicitly disclose an interpolation step of interpolating pixels of the image reconstructed by said reconstructing unit until the size of the image becomes a predetermined size, however, this is known in the art as taught by Hrytzak et al., hereinafter Hrytzak. Hrytzak discloses a method of interpolating a digital image in which "the method can be repeated by moving to the next local position in the input image and so on until the entire image has been interpolated, i.e. until a complete output image of the required size is produced", column 2, line 7-11.

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of Hrytzak into Chen and admitted prior art because Chen and admitted prior disclose a method of generating an image of a virtual space using ray space theory and Hrytzak discloses the generated image can be interpolated into a desired size in order to maximized the view of the interpolated image.

11. As per claim 32, Chen, admitted prior art and Hrytzak demonstrated all the elements as applied to the rejection of independent claim 1, supra, and admitted prior art further discloses wherein ray space data is managed in a (x,u) space, wherein "x"

represents a position where he light ray intersects the X-axis and "u" represents a tangent of an angle the light ray make with the Z-axis (page 2, line 19-23).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of admitted prior art into the invention in order to properly describe an image with a moving view point.

12. As per claim 35, Chen, admitted prior art and Hrytzak demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Chen further discloses the setting unit determines the sampling rate on the basis of the manipulation speed of an object in a virtual space designated by the user ("The movement of the virtual camera, to present different views of the scene, is controlled by the viewer through a suitable input device 18, column 3, line 40-42, since the morphing, thus the sampling rate, is determined by the correspondence between two images and the correspondence depends on the moving speed of the camera).

13. As per claim 36, Chen, admitted prior art and Hrytzak demonstrated all the elements as applied to the rejection of independent claim 1, supra, and Chen further discloses the setting unit determines the sampling rate on the basis of the manipulation speed of an object in a virtual space designated by the user ("The movement of the virtual camera, to present different views of the scene, is controlled by the viewer through a suitable input device 18, column 3, line 40-42, since the morphing, thus the sampling rate, is determined by the correspondence between two images and the correspondence depends on the moving speed of the camera).

14. As per claim 37, Chen, admitted prior art and Hrytzak demonstrated all the elements as applied to the rejection of independent claim 10, supra, and admitted prior art further discloses wherein ray space data is managed in a (x,u) space, wherein "x" represents a position where he light ray intersects the X-axis and "u" represents a tangent of an angle the light ray make with the Z-axis (page 2, line 19-23).

Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teaching of admitted prior art into the invention in order to properly describe an image with a moving view point.

Allowable Subject Matter

15. Claims 34 and 39 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

16. Claims 33 and 38 are allowed.

Response to Arguments

17. Applicant's arguments filed on 2/23/2004 have been fully considered but they are not persuasive.

As per claims 1, 10 and 31, applicant alleges that in Chen, image resolution is always constant. In reply, examiner does not see applicant provides the basis of this argument. Applicant further alleges Chen's sampling rate is performed on a time axis. In reply, Examiner considers Chen also teaches spatial sampling (In the example of Fig. 1,

the movement of the virtual camera is one-dimensional ... can be multi-dimensional", column 7, line 29-33).

Conclusion

18. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Inquiries

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Ryan Yang** whose telephone number is **(703) 308-6133**.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Michael Razavi**, can be reached at **(703) 305-4713**.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 305-47000377.

Ryan Yang
April 28, 2004

MICHAEL RAZAVI
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600